

ON A *GYROCOTYLE* FROM *CHIMÆRA OGILBYI*,
AND ON *GYROCOTYLE* IN GENERAL,

BY W. A. HASWELL, M.A., D.Sc., F.R.S., CHALLIS PROFESSOR
OF BIOLOGY, UNIVERSITY OF SYDNEY.

(Plate vii.)

The Monozoic Cestodes of the genus *Gyrocotyle* (*Amphiptyches*) are, in the adult condition, parasites exclusively of fishes of the order *Holocephali*, and have been found not only in the northern *Chimæra monstrosa*, but in the southern *Callorhynchus antarcticus* and *C. argenteus*. It is, therefore, not a matter for surprise that the new species of the former genus trawled by the "Thetis" in 1898, and described by Mr. E. R. Waite under the name of *C. Ogilbyi*,* proves to be the host of a member of this group. A few months ago Mr. Waite sent me two specimens in alcohol of a species of *Gyrocotyle*, taken from a specimen of *Chimæra Ogilbyi*, recently received by the Australian Museum from Manly.

In comparing these specimens with the published accounts of *G. urna* and *G. rugosa*, and with a preserved specimen and sections of the latter, a difficulty occurs which has to be dealt with at the outset. Contrary opinions are held by different observers as to the orientation of the animal. By Wagener (8), followed by Diesing, Olsson, Monticelli (5, 6), Braun (2, 3), and others, the end bearing the peculiar plicated structure termed the funnel is looked upon as posterior. By Baldwin Spencer (7), and by Lönnberg (4), on the other hand, the funnel end is regarded as

* E. R. Waite, "Scientific Results of the Trawling Expedition of H.M.C.S. 'Thetis.'" Australian Museum, Memoir iv., 1899.

anterior. It will be necessary, therefore, to decide which of these opposed views is to be adhered to in making this comparison.

Spencer's contribution to the subject was published at least a year before Lönnberg's; but the latter reached his conclusion independently, and adduces several reasons of some weight in support of his position. He alleges, in the first place, that the animal creeps in the direction of the end which bears the funnel. On this point I am unable to make any statement, as I have not had an opportunity of observing living specimens. But, in the absence of other evidence, it is worthy of note that Wagener states "Die Schwanzkrause bleibt meist ruhig während der Kopfteil des Thieres sich langsam bewegt."

The direction of the spinules on the surface Lönnberg regards as affording further evidence in favour of his view. If the end with the funnel is posterior, then these spinules lie with their points directed forwards. Further support Lönnberg conceives to be derivable from the structure of the nervous system, nerve-cells being more numerous in the commissure at the end which he looks upon as anterior. Monticelli (5), however, states that the contrary is the case.

But a comparison of the reproductive apparatus of *Gyrocotyle* with that of allied forms appears to me to place it beyond a doubt that the sucker end is that which corresponds to the end usually regarded as anterior. If we take the contrary view it is impossible to trace any correspondence in the arrangement of the parts: whereas a general unity of plan at once becomes apparent on the position becoming reversed. When we bear in mind that, though *Gyrocotyle* is unsegmented, it possesses a number of highly specialised Cestode features in its adult structure, and is characterised, moreover, by the occurrence in its life-history of the peculiar and characteristically Cestode hexacanth larva, the necessity for tracing such a correspondence becomes manifest. The end which bears the sucker is seen, as a result of such a

* Whether or not this corresponds to the anterior end in other classes of Flat-worms is a question outside the limited scope of the present paper.

comparison, to correspond to the scolex end* in the segmented Cestodes, and to that at which the mobile organ is situated in *Caryophyllæus*.*

Lönnberg has shown that *G. urna* is subject to very remarkable variations in form. In its normal condition it has the lateral borders and the characteristic posterior funnel-like organ thrown into a number of complicated plaits. But in some examples the plaits of the lateral borders, or of the funnel, or of both, may be entirely absent; and in some the funnel becomes replaced by a long cylindrical tube. This modification of the funnel has not been observed in *G. rugosa*; but living specimens of that form have not been studied: the degree of folding of the lateral borders has been observed to be subject to variation

In view of these variations it becomes difficult to fix upon any definite and constant differences between the form from *Chimera monstrosa* and that from *Callorhynchus antarcticus*. Braun suggests that the position of the reproductive apertures may afford a means of distinguishing between them.

Spencer's account of these apertures in *G. rugosa* is somewhat confusing owing to certain inconsistencies in the text, and has to be interpreted with the aid of the figures. He describes the presence on the "left" side ventrally of a well-marked somewhat conical and muscular papilla. The male aperture is "on the ventral side just at the base of the papilla, towards the middle line." This statement is not borne out by an examination of the only specimen of *G. rugosa* at my command at present, in which the aperture is situated at the extremity of the papilla, and is not consistent with Spencer's own figures, one of which (Plate ii., fig. 1) represents the opening in question as situated on the margin or approximately so, and another (fig. 4) shows it on the

* That the rejection of Lönnberg's and Spencer's views on the orientation of *Gyrocotyle* appears also to lead, as Benham (1) points out, to a reversal of the usual view with regard to the position of the sucker in *Amphilinea* need only be mentioned here.

ventral surface some little distance from the margin, but manifestly on the summit of the papilla.

If we accept Lönnberg's account of the position of these apertures in *G. urna*, there would appear to be a sufficiently strongly-marked difference in this respect between that species and *G. rugosa*. In the former the male aperture is ventral, situated towards the middle line, and the vaginal aperture is always in front of it on the dorsal surface. In the latter the male aperture is ventral, but marginal or sub-marginal; and the female dorsal, somewhat to the right of the middle, and a little behind the male. A further external difference between the two forms concerns the cirrus.

In the specimen of *G. rugosa* in my possession (figs. 3, 4 and 5) this is a prominent process, conical in shape, its base situated on the ventral side between the middle line and the right margin of the body. It is strongly curved round towards the dorsal side, lying in a deep notch in the right border, its apex actually projecting on the dorsal side of the body. From the appearance presented it is obvious that the specimen has been killed with the parts approximately in the position for self-impregnation, the apex of the penis being approximated towards the vaginal aperture on the dorsal side. There is no evidence of the occurrence of any such arrangement in *G. urna*. On the contrary, Lönnberg states very positively "Da die beiden Genitalöffnungen auf verschiedenen Körperflächen liegen ist natürlich Selbstbefruchtung ganz unmöglich bei diesen Cestoden, und auch Wechsellkreuzung sehr schwierig" (4, p. 40).

The parasite of *Chimæra Ogilbyi* (fig. 1) is more nearly allied to *G. urna* than to *G. rugosa*. How far the slight differences between it and the northern species are of a constant character can only be determined by comparison of large series; in the meantime I refer to it as *G. nigrosetosa*.

The two specimens, which are both large (about 70 mm. in length), resemble one another in most respects. They both have richly plaited borders and a "funnel" with greatly folded walls. The anterior sucker resembles that of *G. urna*.

The spinules (fig. 6) are dark brown or black. Each is a stout cylindrical rod swollen towards the middle, and with the proximal extremity slightly constricted off as a rounded knob. They conform in shape exactly to the description of those of *G. urna* given by Lönnberg. If we are to judge from Spencer's figure the spinules of *G. rugosa* are of simpler shape. They are mainly confined to the dorsal surface, but at the anterior end at the sides of the sucker and on the stalk of the funnel a number extend on to the ventral surface. Over the rest of the ventral surface are scattered a very few; these are all much smaller than those on the dorsal surface. There are very few on the lateral plaits, and none on the funnel. As in *G. urna* and *G. rugosa*, they all lie with their apices directed forwards or forwards and outwards. The longest are 0.3 mm. in length.

On the right border, not far from the anterior extremity (fig. 2), in both specimens, is a well-marked notch. On the dorsal aspect, close to this is the conspicuous aperture of the vagina (♀). The male aperture is on the ventral surface, a little to the right of the middle line, and slightly behind the vaginal opening. There is no cirrus distinguishable in either specimen. The ejaculatory duct has a chitinous internal lining beset with fine denticles or spinules as in most Cestodes. These appear to be absent in *G. rugosa*, but are present in *G. urna*.*

The specimens were not in good condition for minute investigation, and I have not attempted more than a general examination of the structure of the remainder of the reproductive apparatus. So far as my results go they correspond with what has been described by Lönnberg and by Spencer. As Lönnberg has stated, the continuation backwards of the vagina to the receptaculum seminis is a very fine tube which runs on the ventral side of the uterus, and not on the dorsal as represented by Spencer in his coloured diagram. The main vitelline ducts also, which are represented in the same figure on the dorsal side of the ovary, are in reality ventral in position.

* Obviously what Lönnberg (4, p. 38) refers to as cilia are of this nature.

The eggs (fig. 7) are elliptical, about 0.08 mm. in long diameter. They are thus larger than those of most segmented Cestodes, but considerably smaller than those of *G. rugosa*, which measure 0.1 mm., and are the largest Cestode eggs the dimensions of which have been recorded. In *G. nigrosetosa* a circular area of the shell at one pole is much thinner than the rest, and is probably differentiated as an operculum. At the opposite pole there is occasionally, though by no means frequently, a filament, usually very short. Coalescence of two eggs by fusion between their shells is by no means rare. No hooked embryos are present in either of the specimens.

In my specimen of *G. rugosa* the eggs differ from those of *G. nigrosetosa* not only in size, but in the appearance of the shell, which does not appear to be provided with an operculum. Hexacanth embryos are abundant, and are remarkable for their large size and the comparatively colossal dimensions of their hooks. These are disposed in pairs like those of hexacanth embryos in general. In *G. urna* Lönnberg failed to find any hooks, and this circumstance, when we take into account the fact that the observer in question had abundance of material at his disposal, would seem to point to an important difference between the two species with regard to the structure of the embryo.

LITERATURE.

- 1.—BENHAM, W. B.—“A Treatise on Zoology,” edited by E. Ray Lankester. Part iv. “The Platyhelminia, Mesozoa and Nemertini” (1901).
- 2.—BRAUN, M.—“Gyrocotyle, Amphiptyches u. Verwandte.” Centralblatt f. Bakteriologie u. Parasitenkunde. vi. Bd. (1889).
- 3.——————“Vermes” of Bronn’s “Klassen u. Ordnungen des Thierreichs.”
- 4.—LOENBERG, EINAR—“Anatomische Studien über Skandinavische Cestoden.” Kongl. Svenska Vetenskaps-Akademiens Handlingar, Bd. 24.
- 5.—MONTICELLI, F. S.—“Sul sistema nervosa dell’ Amphiptyches urna.” Zool. Anz., 1889.
- 6.——————“Appunti sui Cestodaria.” Atti della R. Accad. dell Scienze fis. e nat. di Napoli, 1892.

- 7.—SPENCER, W. BALDWIN—"The Anatomy of Amphiptyches urna." Trans. R.S. Viet., 1889.
- 8.—WAGENER, R. G.—"Ueber einen neuen in der Chimæra monstrosa gefundenen Eingeweidewurm Amphiptyches urna, Grube und Wagener." Müller's Archiv f. Anat. Physiol. Jahrg. 1852.
- 9.—WILL, H.—"Anatomie von Caryophyllæus mutabilis Rud." Zeitschr. wiss. Zool., lvi. Bd. (1893).

EXPLANATION OF PLATE VII.

Fig. 1.—*Gyrocotyle nigrosetosa*, natural size.

Fig. 2.—*Gyrocotyle nigrosetosa*, anterior end, ventral aspect, magnified; *te.*, lobes of testis; *s.*, sucker; *u.*, uterus; *vit.*, lobes of vitelline glands; ♂, opening of ejaculatory duct; ♀, opening of vagina.

Fig. 3.—*Gyrocotyle rugosa*, dorsal surface of the anterior region (extremity with sucker cut off); *c.*, cirrus; *va.*, opening of vagina.

Fig. 4.—The same specimen, ventral surface.

Fig. 5.—Outline of a transverse section through the specimen of *Gyrocotyle rugosa* represented in figs. 3 and 4, in the region of the cirrus; *v.*, ventral surface; *d.*, dorsal surface; *e.d.*, ejaculatory duct in terminal part of cirrus; *c.*, cirrus.

Fig. 6.—Spinules of *Gyrocotyle nigrosetosa*.

Fig. 7.—Egg of *Gyrocotyle nigrosetosa*.